Fire and Water Study Phase 1 Sampling Plan

Background

The Camp fire in November 2018 burned the towns of Paradise and Magalia, California, and nearby areas, destroying nearly 14,000 homes but leaving about 1,700 homes essentially intact. Returning residents complained of odors and an unpleasant taste in the drinking water, and testing by the local utilities identified benzene and other volatile organic compounds (VOCs). The measured concentrations in the public water distribution system are high in some areas, but spotty without a clear overall pattern. Dead-end service lines that supplied water to a building that burned have the highest likelihood of contamination.

Two drinking water utilities serve the area. The Paradise Irrigation District currently has a "do not drink" advisory for most homes in the town, whereas the Del Oro Water Company (which has four local Districts - Magalia, Paradise Pines, Lime Saddle, and Buzztail) has not issued advisories but has been flushing their water system repeatedly.

Objectives

This study is designed to answer three research questions:

1) What are the benzene and other VOC concentrations inside homes?
2) Are there other contaminants, whether regulated or non-regulated, in the water system?
3) Are there clues to the source of the contamination?

In order to answer these questions, in Phase 1, we will collect drinking water samples at the kitchen tap of approximately 10% of homes (about 175 homes) throughout the fire affected area. We will also ask questions about water consumption, complaints about water quality, and health symptoms; we will collect observations about fire damage and the types of pipes in the home, and we will measure the distance from the service connection at the street to the home. Phase 1 samples will be analyzed for VOCs at the BC Laboratory, Inc. in Bakersfield, CA.

Subject Population

The study population consists of homeowners or renters of occupied or unoccupied residential structures that are still standing after the 2018 Camp fire in Butte County. The homes may be single or multi-family homes, or mobile homes, but must have a functioning indoor tap for sample collection. We will be recruiting in Paradise, Magalia, Lime Saddle, Paradise Pines, Buzztail, and nearby unincorporated areas. Most of our sampling will be within the area burned by the fire, but we will also collect approximately 20 samples just outside the burn area, and in an area that did not lose water pressure for comparison purposes.

Study Team

Name	Contact Information	Role
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Kelly Torres	Kelly.torres@phi.org	Scheduling
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Equipment Needed

Each sampling team must carry the following equipment. Team members are expected to bring their own bag to carry items from the vehicles into the homes, their own flashlight or headlamp, and gardening or other gloves to protect their hands when opening meter boxes.

- ☐ Logbook
- ☐ 2-3 Pens
- ☐ Permanent fine-point pen (Sharpie)
- ☐ Map of the area
- ☐ List of addresses for each sampling day
- ☐ Large screwdriver for opening water meter boxes
- ☐ Gloves (gardening gloves are best)
- ☐ Flashlight or headlamp for examining pipes
- ☐ Zircon sonic measuring device or 100 foot tape measure
- ☐ Clipboards or Manila folders containing:
    - This sampling plan
    - 20 Consent forms
    - 10 Questionnaires
    - 10 Site observation forms
    - 2 Chain of custody forms
    - 1 Guide to pipes
- ☐ Cell phones (with cameras; or separate cameras)
- ☐ 10 Sample collection kits
- ☐ 1 bottle of HPLC organic-free water
- ☐ Box of nitrile gloves
- ☐ Roll of paper towels
- ☐ Cooler with ice

Log book

Each day of sampling, the following information will be recorded in the logbook for each sample team:

- Beginning of day:
  - Date, time; team members and their responsibilities
- At each sampling site:
  - Location code
  - Time of arrival and time of departure
  - Other study personnel on site (if any)
  - Any notes or observations that are not captured on the forms
  - Whether or not the aerator was removed
  - Sample numbers collected at the location
  - Any deviations from sampling plans and procedures
- Changes in personnel and responsibilities with reasons for the changes

Do not put any protected health information (PHI) in the log book. Use only location and sample codes.

Photographs

Photographs will be taken at the sampling locations and at other areas of interest on the site or sampling area. They will serve to verify information entered in the field logbook. Do not take any photographs of study participants or members of the community. Photographs of members of the sampling team are permissible. If possible, turn on the date/time function on your camera. Also, take a photo of the participant number for the home prior to taking any photos of the location, to help demarcate which photos go with which location. For each photograph taken, the following information will be written in the logbook:

- Time, date, location
- Description of the object photographed
- Initials of person taking the photograph

Observation Checklist

The observation checklist may be completed either before or after sample collection. The distance from the water meter to the home will be measured using the Zircon sonic measure (if the distance is less than 50 feet), or a tape measure, or by pacing out the distance.

The water meter is generally found along the property boundary near the street. It is a rectangular box that may be plastic or concrete. If it is closed, use a screwdriver to pry it up to check and photograph the meter and water pipe at the service connection.

Wear protective gloves when opening meter boxes and when reaching into meter boxes to tap or wipe off pipes.

If you see two meter boxes side-by-side with evidence that both may be served by the same connection off the water main, or a single meter box that serves multiple structures on a property, mark these as serving more than one home.

The type of pipe can be evaluated using the instructions and photo key attached. We are interested in the pipe that is on the side of the meter closer to the house. Also examine the pipes where they enter the house, at the water meter, the washing machine, and under the sink. However, if the homeowner knows what kind of pipes are plumbing the home, this information can be used instead.

Document the pipes, the structure(s) on the property, and the condition of the water meter and yard with photographs.

Informed Consent

A team member who has undergone training in human subjects research must obtain written informed consent from the homeowner if consent was not obtained prior to the visit. Ensure that the homeowner reads and understands the entire consent document, and has an opportunity to ask any questions that they may have. This should happen prior to collection of the water sample, and must happen prior to questionnaire administration. Provide the homeowner with a copy of the consent form for their files.

If the homeowner is not present, it may be possible to get verbal consent from them over the phone, with authorization to delegate signing authority to a family member who is present. If no authorized person is present, then we can collect a water sample for later analysis but we cannot administer a questionnaire. We will then attempt to reach the homeowner later for consent.

Questionnaire Administration

A team member that has undergone training in human subjects research must administer the questionnaire. Request that the participant complete the questionnaire. Provide the questionnaire and a pen, and allow them to complete it without comment, but be available to answer questions if there are any. Use the extra questionnaire pages to collect water consumption, water use, and health information for each person living in the home, not just the person who fills out the questionnaire.

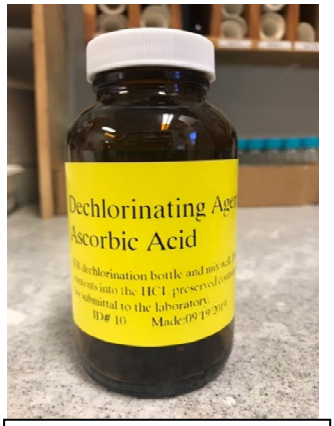
Labeling

All samples collected must be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have pre-assigned, identifiable, and unique numbers. The sample labels must include the following information, written using a fine point permanent pen: Sample number, date of collection, and initials of the person who collected the sample. Every sample will be assigned a unique sample number that will include the 4 character household ID followed by a dash and a single digit sample ID number (1-3 for each of the three Volatile Organic Analysis (VOA) samplers).

VOA Samplers

Water Sample Collection

1) Unscrew and remove the aerator from the kitchen faucet. If the aerator cannot be easily removed, collect the sample with the aerator on, and note that in the log book.
2) Cover the counter next to the sink with 2-3 sheets of paper towel.
3) Remove one amber "dechlor" sample bottle (see photo below) and three small clear glass VOA samplers (see photo above) from the cooler, unwrap the bottles, and set the bottles on the paper towels. Do not remove caps.
4) Write the date, time (24 hour clock), and sample identification number on the label of the bottle with a permanent pen (see labeling section above).
5) Put on nitrile gloves.
6) Turn on the cold water faucet so that water comes out at a low, steady volume that does not splash in the sink (laminar flow).
7) Count to 3 seconds ("three-one-thousand") while opening an amber 250 ml "dechlor" sample bottle. This allows water from the faucet itself to run out, and ensures we will be sampling from the household pipes.
8) Place the open "dechlor" sample bottle under the running water. Do not rinse the bottle as it contains a dechlorinating agent. Slowly fill the bottle by allowing the water to gently flow down the inside of the bottle. Fill the bottle to the top and replace the cap. Note that the next three steps need to be performed quickly and with as little agitation as possible to avoid evaporation of any VOCs.
9) Invert the bottle 1-2 times to mix the water with the dechlorinating agent. Do not shake.
10) Reopen the bottle and quickly transfer the water into each of the three labeled clear glass 40 ml volatile organic analysis (VOA) sampling containers. Create a positive meniscus of water at the top so that the bottle is actually overfilled.
11) Quickly cap each bottle so that no air bubbles are present. Check to make sure that the bottle does not contain air bubbles by inverting the bottle several times and tapping gently on a vertical surface to dislodge any air bubbles. If there are bubbles, reopen briefly and add more water.
12) Place the three closed VOA bottles and the closed dechlor bottle (still containing any remaining water) into a ziplock bag. Ensure that the bottles and the ziplock are all tightly closed. Place the bag into the cooler on ice. Package the cooler the same way it was delivered, to protect against breakage.
13) Replace the aerator on the sink, being careful not to cross-thread and damage the tap, and use paper towels to clean up any water on the counter.
14) Fill out the chain of custody form with the sample collection information. Record the site location, name of the person who collected the sample, and date and time of collection.



Amber "dechlor" bottle

Note that the VOA bottles contain a small amount of acid. Be careful not to spill or splash the contents of the VOA on yourself or on the counter. If you do, flush the affected area thoroughly with water for 15 minutes and contact the principal investigator.

Chain of Custody

A chain of custody form must be completed by each team for each day of sampling, and sent with the cooler of samples for each shipment (i.e., each day). Do not put the address of the home on the chain-of-custody form. Use only the study ID number assigned to the sample.

The chain-of-custody form will identify each sample and maintain the custodial integrity of the samples. A sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, or locked up (e.g., in a car). Until the samples are given to the courier, the custody of the samples will be the responsibility of the sampling team member who is collecting the water samples that day. Upon transferring the cooler of samples to the courier, the sampling team member will sign the chain-of-custody form in the "relinquished by" box and note date, time, and person to whom the samples were relinquished.

Courier Pick-Up

Courier pick-up for BC Laboratories will be **no later than 6:00 PM each day** except Sunday. The courier will be in the parking lot of Starbucks at 6344 Skyway Road in Paradise at 5:30 PM. If all teams are done earlier, we can arrange for earlier courier service. If one team is done early, they can give their samples to another team, but must relinquish custody on the chain of custody form. On Sundays, or if a team misses the courier, we will hold the samples in a hotel room overnight, ensuring that we keep them on ice overnight and refresh the ice in the morning.

Quality Control

One field blank will be collected by each team each day to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring High Performance Liquid Chromatography (HPLC) organic-free water (provided by the lab in the coolers) into a sampling container at one randomly-selected home each day. The selected home will be chosen randomly in advance, and clearly marked on the day's schedule. The field blanks will be preserved, packaged, and sealed in the same manner described for the water samples. A separate sample number will be assigned to each field blank sample, and it will be submitted blind to the laboratory.

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the samples, and if cross contamination in the form of VOC migration has occurred between the collected samples. One trip blank will be submitted to the laboratory for analysis with every shipment of samples for VOC analysis. Trip blanks are 40-mL vials that have been filled with HPLC-grade water that has been purged so it is VOC free and shipped with the empty sampling containers to the site or sampling area prior to sampling. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same cooler with the samples collected for analysis. The trip blanks will be preserved, packaged, and sealed in the manner described for the water samples. A separate sample number will be assigned to each trip sample and it will be submitted blind to the laboratory. **Do not open the trip blanks!**

For each cooler that is shipped or transported to an analytical laboratory a filled VOA vial will be included that is marked “temperature blank.” This blank will be used by the sample custodian to check the temperature of samples upon receipt.

Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When possible, the Principal Investigator will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the log book.

Health and Safety

If any member of the team has any health or safety concerns about entering any home for sampling, do not enter the home. Instead, contact the Principal Investigator to discuss the situation and determine the best course of action.

Team members should always travel in pairs. Never leave a team member alone.

Wear closed sturdy shoes (no sandals or high heels), socks, and long pants at all times. Dress professionally but casually. Wear sunscreen on any exposed skin. Stop for water and food when necessary; there are multiple places in town to purchase food, water, or other necessities.

Protect your hands with gloves when opening or reaching into meter boxes.

For emergencies: Nearest medical center: Adventist Health Center, 5125 Skyway, Paradise, 530-872-2000

Attachments:

Map of the study area

Chain of Custody form

Field guide to pipes